

CLAIMS

1. A memory system comprising:

a memory controller;

at least one memory device; and

an optical path connected between said memory controller and said at least one memory device for optically passing data between said controller and said at least one memory device.
2. The memory system of claim 1, wherein said controller transmits data to said at least one memory device through said optical path.
3. The memory system of claim 1, wherein said controller receives data from said at least one memory device through said optical path.
4. The memory system of claim 1, wherein said data includes at least one of read and write data.
5. The memory system of claim 1, wherein said data includes address data transmitted from said controller to said at least one memory device.
6. The memory system of claim 1, wherein said data includes command data transmitted from said controller to said at least one memory device.

7. The memory system of claim 1, wherein said data includes a clock signal.
8. The memory system of claim 1, wherein said data includes control data.
9. The memory system of claim 1, wherein said optical path comprises a plurality of multiplexed optical channels, said data being transmitted over said multiplexed optical channels.
10. The memory system of claim 1, further comprising an electro-optical converter for converting an electrical signal output from said controller to an optical signal for transmission on said optical path.
11. The memory system of claim 10, wherein said converter is wavelength-adjustable.
12. The memory system of claim 10, further comprising an electro-optical converter for converting an optical signal on said optical path to an electrical signal and transmitting said electrical signal to said controller.
13. The memory system of claim 1 further comprising:

an electro-optical converter for converting an electrical signal output from said at least one memory device to an optical signal for transmission on said optical path.

14. The memory system of claim 1 further comprising:

an electro-optical converter for converting an optical signal on said optical path to an electrical signal and transmitting said electrical signal to said at least one memory device.

15. The memory system of claim 9, further comprising:

a multiplexer associated with said controller for multiplexing said optical channels, and

a demultiplexer associated with said at least one memory device for demultiplexing said multiplexed optical channels.

16. The memory system of claim 9, further comprising:

a multiplexer associated with said at least one memory device for multiplexing optical channels and providing multiplexed optical channels to said optical path; and

a demultiplexer associated with said memory controller for demultiplexing said multiplexed optical channels.

17. The memory system of claim 9, further comprising:

an optical multiplexer and demultiplexer located on each side of said optical path.

18. The memory system of claim 17, wherein said data includes at least read and write data.

19. The memory system of claim 17, wherein said data includes command data.

20. The memory system of claim 17, wherein said data includes address data.

21. The memory system of claim 17, said data includes a clock signal.

22. The memory system of claim 17, wherein said data includes control data.

23. The memory system of claim 17, further comprising:

electrical paths connected between said controller and said at least one memory device for passing data between said controller and memory device.

24. The memory system of claim 1, wherein said at least one memory device is located on a memory module.

25. The memory system of claim 24, further comprising:

an optical coupler at said memory module, having a connector for connecting with said optical path.

26. The memory system of claim 11, further comprising:

a wavelength sensing mechanism connected to said controller, for providing wavelength information to said controller with respect to an optical signal on said optical path.

27. The memory system of claim 26, wherein said wavelength sensing mechanism is located at a controller side of said optical path.

28. The memory system of claim 26, wherein said controller provides wavelength adjustment information to said converter.

29. The memory system of claim 1, wherein said optical path comprises a single optical path between said controller and at least one memory device for passing at least read/write data present on a plurality of electrical paths between said controller and at least one memory device.

30. The memory system of claim 29 wherein said single optical path further passes command data between said controller and at least one memory device.

31. The memory system of claim 29 wherein said single optical path further passes address data between said controller and at least one memory device.

32. The memory system of claim 29 wherein said single optical path further passes a clock signal between said controller and at least one memory device.

33. The memory system of claim 1 wherein said data includes read/write data which originates on a plurality of electrical paths, said optical path comprising a plurality of discrete optical guides respectively associated with said electrical path.

34. The memory system of claim 1 wherein said data includes command data which originates on a plurality of electrical paths, said optical path comprising a plurality of discrete optical guides respectively associated with said electrical path.

35. The memory system of claim 1 wherein said data includes address data which originates on a plurality of electrical paths, said optical path comprising a plurality of discrete optical guides respectively associated with said electrical path.

36. The memory system of claim 1 wherein said data includes clock signal data which originates on an electrical path, said optical path comprising a discrete optical guide respectively associated with said electrical path.

37. The memory system of claim 1 wherein said data includes clock signal data which originates on a plurality of electrical signal paths, said optical path comprising a plurality of discrete optical guides respectively associated with said electrical signal paths.

38. The memory system of claim 1 wherein said data includes control signal data which originates on an electrical signal path, said optical path comprising a discrete optical guide associated with said electrical signal path.

39. The memory system of claim 1, wherein said controller, at least one memory device, and optical path are all integrated on the same die.

40. The memory system of claim 1, further comprising:

a processor, for communicating with said at least one memory device, wherein said controller, at least one memory device, processor, and optical path are all integrated on the same die.

41. The memory system of claim 1, further comprising:

a processor, for communicating with said at least one memory device, wherein said, processor and said at least one memory device are provided on separate dies and communicate via said optical path.

42. The memory system of claim 41, wherein said separate dies are provided in a common package.
43. The memory system of claim 41, wherein said separate dies are separately packaged and said optical path interconnects said packages.
44. The memory system of claim 24, wherein said memory module comprises an electro-optical converter for connecting optical data from said optical path to electrical signals for said at least one memory device.
45. A computer system, comprising:
- a processor;
 - a memory system connected to said processor, said memory system comprising:
 - a memory controller;
 - at least one memory device; and
 - an optical path connected between said memory controller and said at least one memory device for optically passing data between said controller and said at least one memory device.
46. A computer system of claim 45, wherein said controller transmits data to said at least one memory device through said optical path.

47. A computer system of claim 45, wherein said controller receives data from said at least one memory device through said optical path.
48. A computer system of claim 45, wherein said data includes at least one of read and write data.
49. A computer system of claim 45, wherein said data includes address data transmitted from said controller to said at least one memory device.
50. A computer system of claim 45, wherein said data includes command data transmitted from said controller to said at least one memory device.
51. A computer system of claim 45, wherein said data includes a clock signal.
52. A computer system of claim 45, wherein said data includes control data.
53. A computer system of claim 45, wherein said optical path comprises a plurality of multiplexed optical channels, said data being transmitted over said multiplexed optical channels.

54. A computer system of claim 45, further comprising an electro-optical converter for converting an electrical signal output from said controller to an optical signal for transmission on said optical path.

55. A computer system of claim 54, wherein said converter is wavelength-adjustable.

56. A computer system of claim 54, further comprising an electro-optical converter for converting an optical signal on said optical path to an electrical signal and transmitting said electrical signal to said controller.

57. A computer system of claim 45, comprising an electro-optical converter for converting an electrical signal output from said at least one memory device to an optical signal for transmission on said optical path.

58. A computer system of claim 45, comprising an electro-optical converter for converting an optical signal on said optical path to an electrical signal and transmitting said electrical signal to said at least one memory device.

59. A computer system of claim 52, comprising a multiplexer associated with said controller for multiplexing said optical channels, and

a demultiplexer associated with said at least one memory device for demultiplexing said multiplexed optical channels.

60. A computer system of claim 52, comprising a multiplexer associated with said at least one memory device for multiplexing optical channels and providing multiplexed optical channels to said optical path; and

a demultiplexer associated with said memory controller for demultiplexing said multiplexed optical channels.

61. A computer system of claim 52, comprising an optical multiplexer and demultiplexer located on each side of said optical path.

62. A computer system of claim 61, wherein said data includes at least read and write data.

63. A computer system of claim 61, wherein said data includes command data.

64. A computer system of claim 61, wherein said data includes address data

65. A computer system of claim 61, wherein said data includes a clock signal.

66. A computer system of claim 61, wherein said data includes control data.

67. A computer system of claim 61, further comprising:

electrical paths connected between said controller and said at least one memory device for passing data between said controller and memory device.

68. A computer system of claim 45, wherein said at least one memory device is located on a memory module.

69. A computer system of claim 68, further comprising:

an optical coupler at said memory module, having a connector for connecting with said optical path.

70. A computer system of claim 55, further comprising:

a wavelength sensing mechanism connected to said controller, for providing wavelength information to said controller with respect to an optical signal on said optical path.

71. A computer system of claim 70, wherein said wavelength sensing mechanism is located at a controller side of said optical path.

72. A computer system of claim 70, wherein said controller provides wavelength adjustment information to said converter.

73. The computer system of claim 45, wherein said optical path comprises a single optical path between said controller and at least one memory device for passing at least read/write data present on a plurality of electrical paths between said controller and at least one memory device.

74. The computer system of claim 45, wherein said single optical path further passes command data between said controller and at least one memory device.

75. The computer system of claim 45, wherein said single optical path further passes address data between said controller and at least one memory device.

76. The computer system of claim 45, wherein said single optical path further passes a clock signal between said controller and at least one memory device.

77. The computer system of claim 45, wherein said data includes read/write data which originates on a plurality of electrical paths, said optical path comprising a plurality of discrete optical guides respectively associated with said electrical path.

78. The computer system of claim 45, wherein said data includes command data which originates on a plurality of electrical paths, said optical path comprising a plurality of discrete optical guides respectively associated with said electrical path.

79. The computer system of claim 45, wherein said data includes address data which originates on a plurality of electrical paths, said optical path comprising a plurality of discrete optical guides respectively associated with said electrical path.

80. The computer system of claim 45, wherein said data includes clock signal data which originates on an electrical path, said optical path comprising a discrete optical guide respectively associated with said electrical path.

81. The computer system of claim 45, wherein said data includes clock signal data which originates on a plurality of electrical signal paths, said optical path comprising a plurality of discrete optical guides respectively associated with said electrical signal paths.

82. The computer system of claim 45, wherein said data includes control signal data which originates on an electrical signal path, said optical path comprising a discrete optical guide associated with said electrical signal path.

83. The computer system of claim 45, wherein said controller, at least one memory device, and optical path are all integrated on the same die.

84. The computer system of claim 45, wherein said processor, controller, at least one memory device and optical path are all integrated on the same die.

85. The computer system of claim 45, wherein said processor and at least one memory device are provided on separate dies and communicate via said optical path.

86. The computer system of claim 85, wherein said separate dies are provided in a common package.

87. The computer system of claim 85, wherein said separate dies are separately packaged and said optical path interconnects said packages.

88. The computer system of claim 68, wherein said memory module comprises an electro-optical converter for connecting optical data from said optical path to electrical signals for said at least one memory device.

89. An electro-optical converter for a memory system comprising:

at least one input for receiving an electrical data signal from a memory controller;

at least one device for converting said data signal to an optical signal; and

at least one optical output for transmitting said optical signal into an optical path.

90. The electro-optical converter of claim 89, further comprising:

said at least one device for converting being wavelength-adjustable.

91. The electro-optical converter of claim 89, wherein said optical output further comprises either a light emitting diode or injection laser diode.
92. An electro-optical converter for a memory system comprising:
- at least one input for receiving an electrical data signal from at least one memory device;
 - at least one device for converting said data signal to an optical signal; and
 - at least one optical output for transmitting said optical signal into an optical path.
93. The electro-optical converter of claim 92, further comprising:
- said at least one device for converting being wavelength-adjustable.
94. The electro-optical converter of claim 92, wherein said optical output further comprises either a light emitting diode or injection laser diode.
95. An electro-optical converter for a memory system comprising:
- at least one input for receiving a optical data signal from an optical path;
 - at least one electro-optical converter for converting said received data signal to an electrical signal; and

at least one electrical output for transmitting said output signal to an electrical path of a memory controller.

96. The electro-optical converter of claim 95, further comprising:

said at least one electro-optical converter being wavelength-adjustable.

97. The electro-optical converter of claim 95, wherein said optical output further comprises either a photodiode.

98. An electro-optical converter for a memory system comprising:

at least one input for receiving a optical data signal from an optical path;

at least one electro-optical converter for converting said received data signal to an electrical signal; and

at least one electrical output for transmitting said output signal to an electrical path of a memory device.

99. The electro-optical converter of claim 98, further comprising:

said at least one electro-optical converter being wavelength-adjustable.

100. The electro-optical converter of claim 98, wherein said optical output further comprises a photodiode.

101. A method of operating a memory system comprising:

receiving electrical signals from a memory controller;

converting said received electrical signals into optical signals; and

transmitting said optical signals over an optical path to a memory device.

102. The method of claim 101, further comprising:

said controller receiving data from said at least one memory device through said optical path.

103. The method of claim 102, wherein said data includes at least one of read and write data.

104. The method of claim 102, wherein said data includes address data transmitted from said controller to said at least one memory device.

105. The method of claim 102, wherein said data includes command data transmitted from said controller to said at least one memory device.

106. The method of claim 102, wherein said data includes a clock signal.
107. The method of claim 102, wherein said data includes control data.
108. The method of claim 102, wherein said optical path comprises a plurality of multiplexed optical channels, said data being transmitted over said multiplexed optical channels.
109. The method of claim 102, further comprising:
converting an electrical signal output from said controller to an optical signal for transmission on said optical path.
110. The method of claim 109, wherein said conversion step further comprises:
adjusting the wavelength of said optical path.
111. The method of claim 108, further comprising:
multiplexing said optical channels, and
demultiplexing said multiplexed optical channels.
112. The method of claim 108, further comprising:

multiplexing optical channels and providing multiplexed optical channels to said optical path; and

demultiplexing said multiplexed optical channels.

113. The method of claim 108, further comprising:

an optical multiplexer and demultiplexer located on each side of said optical path.

114. The method of claim 101, wherein said at least one memory device is located on a memory module.

115. The method of claim 114, further comprising:

an optical coupler at said memory module, having a connector for connecting with said optical path.

116. The method of claim 101, further comprising:

providing wavelength information to said controller with respect to an optical signal on said optical path.

117. The method of claim 116, wherein said controller provides wavelength adjustment information to said converter.

118. The method of claim 101, further comprising:

combining a plurality of electrical paths between said controller and at least one memory device into a single optical path between said controller and at least one memory device for passing at least read/write data present on a

119. The method of claim 118 wherein said single optical path further passes command data between said controller and at least one memory device.

120. The method of claim 118 further comprising:

passing address data between said controller and at least one memory device along said single optical path.

121. The method of claim 101, further comprising:

integrating said controller, at least one memory device, and optical path all on the same die.

122. The method of claim 121, further comprising:

integrating a processor for communicating with said at least one memory device with said controller, at least one memory device, and optical path all within the same die.

123. The method of claim 101, further comprising:

providing a processor for communicating with said at least one memory device on separate dies; and

communicating between said processor and at least one memory device via said optical path.

124. The method of claim 123, further comprising:

providing said separate dies in a common package.

125. The method of claim 123, further comprising:

separately packaging said separate dies; and

interconnecting said packages via said optical path.

126. A method of operating a memory system comprising receiving electrical signals from at least one memory device;

converting said received electrical signals into optical signals; and

transmitting said optical signal over an optical path to a memory controller.

127. The method of claim 126, further comprising:

said controller receiving data from said at least one memory device through said optical path.

128. The method of claim 127, wherein said data includes at least one of read and write data.

129. The method of claim 127, wherein said data includes address data transmitted from said controller to said at least one memory device.

130. The method of claim 127, wherein said data includes command data transmitted from said controller to said at least one memory device.

131. The method of claim 127, wherein said data includes a clock signal.

132. The method of claim 127, wherein said data includes control data.

133. The method of claim 127, wherein said optical path comprises a plurality of multiplexed optical channels, said data being transmitted over said multiplexed optical channels.

134. The method of claim 126, further comprising:

converting an electrical signal output from said controller to an optical signal for transmission on said optical path.

135. The method of claim 134, wherein said conversion step further comprises:
adjusting the wavelength of said optical path.
136. The method of claim 133, further comprising:
multiplexing said optical channels, and
demultiplexing said multiplexed optical channels.
137. The method of claim 133, further comprising:
multiplexing optical channels and providing multiplexed optical channels to said optical path; and
demultiplexing said multiplexed optical channels.
138. The method of claim 133, further comprising:
an optical multiplexer and demultiplexer located on each side of said optical path.
139. The method of claim 126, wherein said at least one memory device is located on a memory module.
140. The method of claim 139, further comprising:

an optical coupler at said memory module, having a connector for connecting with said optical path.

141. The method of claim 126, further comprising:

providing wavelength information to said controller with respect to an optical signal on said optical path.

142. The method of claim 141, wherein said controller provides wavelength adjustment information to said converter.

143. The method of claim 126, further comprising:

combining a plurality of electrical paths between said controller and at least one memory device into a single optical path between said controller and at least one memory device for passing at least read/write data present on a

144. The method of claim 143 wherein said single optical path further passes command data between said controller and at least one memory device.

145. The method of claim 143 further comprising:

passing address data between said controller and at least one memory device along said single optical path.

146. The method of claim 126, further comprising:

integrating said controller, at least one memory device, and optical path all on the same die.

147. The method of claim 146, further comprising:

integrating a processor for communicating with said at least one memory device with said controller, at least one memory device, and optical path all within the same die.

148. The method of claim 126, further comprising:

providing a processor for communicating with said at least one memory device on separate dies; and

communicating between said processor and at least one memory device via said optical path.

149. The method of claim 148, further comprising:

providing said separate dies in a common package.

150. The method of claim 148, further comprising:

separately packaging said separate dies; and

interconnecting said packages via said optical path.

151. The memory system of claim 9, wherein said plurality of multiplexed optical channels use Time Division Multiplexing (TDM).

152. The memory system of claim 9, wherein said plurality of multiplexed optical channels use Wave Division Multiplexing (WDM).

153. The memory system of claim 9, wherein said plurality of multiplexed optical channels use Frequency Division Multiplexing (WDM).

154. The memory system of claim 1, wherein said optical path optically passes compressed data.

155. The computer system of claim 53, wherein said plurality of multiplexed optical channels use Time Division Multiplexing (TDM).

156. The computer system of claim 53, wherein said plurality of multiplexed optical channels use Wave Division Multiplexing (WDM).

157. The computer system of claim 53, wherein said plurality of multiplexed optical channels use Frequency Division Multiplexing (WDM).

158. The computer system of claim 45, wherein said optical path optically passes compressed data.

159. The method of claim 108, wherein said plurality of multiplexed optical channels use Time Division Multiplexing (TDM).

160. The method of claim 108, wherein said plurality of multiplexed optical channels use Wave Division Multiplexing (WDM).

161. The method of claim 108, wherein said plurality of multiplexed optical channels use Frequency Division Multiplexing (WDM).

162. The method of claim 101, wherein said step of transmitting further comprises transmitting compressed data.